ECONOMIC GROWTH CENTER

YALE UNIVERSITY

Box 1987, Yale Station
New Haven, Connecticut

CENTER DISCUSSION PAPER NO. 271

NEOCLASSICAL THEORY AND THE OPTIMIZING PEASANT:

AN ECONOMETRIC ANALYSIS OF MARKET FAMILY LABOR SUPPLY

IN A DEVELOPING COUNTRY

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November 1977

I. Introduction

A considerable body of literature concerned with the process of economic development has characterized rural labor markets in developing countries as uncompetitive -- rural wages are presumed to be institutionally set at levels above the "market" equilibrium and significant under- and unemployment of labor is assumed to exist (see, for example Lewis [14], Ranis and Fei [17], Robinson [18], and Sen [27]). These characterizations, however, have rarely been subject to rigorous empirical examination, nor has the non-competitive distribution of market (paid) employment among rural househousholds been well-specified. Among studies using rural labor market data, Rodgers [19], ignoring the identification problem, concludes that the competitive model is inapplicable based on a gross negative correlation between wage rates and aggregate employment across seven Indian villages. In a more richly detailed study, however, Hansen [8] presents descriptive evidence that household members in rural Egypt are employed for a considerable number of days during the year and other data which would appear consistent with a competitive framework.[1] Hansen also finds a strong positive correlation between rural wages and hours worked per day during the year for males, females and children. Given that the seasonal pattern of wages is fully anticipated by workers this result can be interpreted as evidence of the positive compensated substitution effect implied in neoclassical labor supply models (see Ashenfelter and Heckman [2]). Hansen does not, however, attempt to explain the cross-sectional variation in annual employment among families.

In this paper a neoclassical framework based on competitive assumptions is utilized to describe market (for pay) labor supply behavior

in two-person households in developing countries and is tested on micro data from India. While the implicit assumption underlying most of the development literature is that this framework is inappropriate in such a context, many characteristics of rural areas of developing nations may make the application of the neoclassical labor supply model more appealing than in developed-country labor markets -- labor is less heterogeneous (but wage rates within narrowly-defined occupations vary greatly because of geographical immobility), non-pecuniary differences in wage-jobs are likely to be fewer, taxation of savings may be ignored,[2] and time worked may be more flexible.[3] Unfortunately, the standard neoclassical family labor supply model, designed to explain behavior in developed-country labor markets, as presented in Kosters [12], Ashenfelter and Heckman [2], and Knieser [11], provides few predictions that are testable without high quality data on non-earnings income, which are particularly difficult to obtain in developing countries.[4] It is shown here, however, that the extension of the theory to households owning land, who make up a major portion of rural households in India, and the comparison of landless and landholding household market supply relationships yields an array of refutable predictions not requiring the estimation of compensated effects. For instance, it is demonstrated that the gross own wage effect on labor supplied to the market should be algebraically less in landless than in land-owning households and that if schooling augments the allocative ability or technical efficiency of farm managers (or their wives) that the labor supply-education relationships should be more negative in landholding households. Thus, as a by-product of the theoretical analysis, a framework is established for testing for the

marginal efficiency role of schooling in agriculture based on labor supply behavior.

A limitation of the analysis is that it is both a test of the competitive framework--in which an individual's employment within a labor market, given the market wage, is determined only by supply behavior -- and the neoclassical model. Thus it is possible that the predictions derived from the theory may be contradicted empirically not because rural labor markets are noncompetitive but because the neoclassical model of "peasant" behavior specified is wrong or incomplete. Alternatively, of course, peasants may be "neoclassical" but institutional restrictions on employment not taken into account in the analysis may foil attempts to test for such behavior. The empirical results obtained, however, are supportive of the behavioral implications of the neoclassical-competitive model.

In section 2, the model of landless household labor supply in which the husband and wife are earners is briefly reviewed. A corresponding model for landholding households is formulated and the relevant comparative statics are derived and compared to those of the landless model. Landless and landholding models in which wives devote all their time to household activities are also briefly considered. Data from a rural household survey from India are then used to test the set of predictions pertaining to the market labor supply of males and females in landless and landholding households derived from the models in section 3. Section 4 contains a brief summary and conclusion.

2. Theoretical Analysis

Landless Households

The model of the landless household corresponds to the standard model applied to developed country data, as in Kosters. [12], Heckman and Ashenfelter [2] and Kneiser [11], and will be briefly set out here.

The household is assumed to act as if it maximized a monotonic twice-continuously differentiable, strictly concave household utility function, as in (1):

$$(1) \quad U^N = g \, (X^N, \, M^N, \, F^N; \, E_M^N, \, E_F^N)$$

where U^N is the utility of the household without land, X^N is the amount of market goods consumed and M^N, F^N represent the non-market time of each household member (husband and wife). E_M^N and E_F^N are the schooling levels of the husband and wife, which are assumed to influence the demand for non-market time.[5]

The full-income constraint for the landless household is given by (2):

$$(2) \quad \Omega \, (W_F + W_M) + I^N = W_M M^N + W_F F^N + X^N$$

where Ω is the total time available to each family member, W_M and W_F are the market wage rates of male and female laborers, and I^N is asset income. Implicit in (2) is the assumption that each family member can work for any amount of time without affecting his (her) wage;[6] thus family employment, occurring only in the market, is determined soley by

supply factors. It is initially assumed that the husband and wife spend some time in the market; the behavior of households in which the wife is a non-earner is discussed below. With $\lambda_M^N = \Omega - M^N$, $\lambda_F^N = \Omega - F^N$ (2) can be rewritten in terms of market time:

(3) $\quad \lambda_M^N W_M + \lambda_F^N W_F + I^N - X^N = 0$

The appropriate Lagrangean equation is thus:

(4) $\quad V^N = g(X^N, M^N, F^N; E_M^N, E_F^N) + \mu^N [\lambda_M^N W_M + \lambda_F^N W_F + I^N - X^N]$

where μ^N is the Lagrangean multiplier. If only interior solutions are considered, first-order conditions for a utility maximum are:

(5) $\quad g_X - \mu^N = 0$

(6) $\quad g_M - \mu^N W_M = 0$

(7) $\quad g_F - \mu^N W_F = 0$

(8) $\quad \lambda_M^N W_M + \lambda_F^N W_F + I^N - X^N = 0$

Total differentiation of (5) through (8) yields the set of differential equations, in matrix form:

(9) $\quad \begin{bmatrix} g_{XX} & g_{XM} & g_{XF} & -1 \\ g_{MX} & g_{MM} & g_{MF} & -W_M \\ g_{FX} & g_{FM} & g_{FF} & -W_F \\ -1 & -W_M & -W_F & 0 \end{bmatrix} \begin{bmatrix} dX^N \\ dM^N \\ dF^N \\ d\mu^N \end{bmatrix} = \begin{bmatrix} 0 \\ \mu^N dW_M \\ \mu^N dW_F \\ (-\lambda_M^N dW_M - \lambda_F^N dW_F - dI^N) \end{bmatrix}$

normal

is necessary , from (12) that the husband's and wife's nonmarket time be complementary and that the compensated cross effect on the husband's labor supply dominate the weighted income effect. If $\delta_M^N/\delta W_F \leq 0$, which is consistent with either complementarity or substitutability, the sign of the differential in own gross labor supply effects between households differing by the wife's work status cannot be predicted. Thus if all family members in developing countries were strictly wage earners, without data of sufficient quality allowing relatively precise estimates of "pure" income effects (and thus of compensated substitution effects) neoclassical labor supply theory could not be readily used as a framework against which to contrast empirically alternative theories of wage-employment relationships.[8] Not all participants in rural labor markets are members of landless households, however.[9] For families with land or other productive assets the model described above is incomplete since it does not take into account family labor activities. The standard (landless) model is modified accordingly in the next section to obtain a /richer test of the neoclassical frame-work.

Landholding Households

Landholding households are distinguished from landless households, for the purposes here, by the feature that in the former at least one household member combines part of his (her) time with other productive assets (chiefly land) owned by the household for the purpose of generating (farm) income. Initially it is assumed that both family members spend time in farm production. Households owning land or other productive assets are assumed to maximize a utility function identical to that of landless households:

(14) $U^L = g(X^L, M^L, F^L; E_M^L, E_F^L)$

The schooling levels of the husband and wife in landholding households are also assumed to affect the demand for household time in the same way as in landless households.

The production of farm output Q, derived from the production inputs (including labor) of the landholding family, is described by a twice differentiable, strictly concave production function (15):

(15) $Q = \Gamma(m, f, \kappa; e)$

where m and f are the quantities of male and female labor used in farm production κ is a vector of the prices and quantities of other farm inputs, including land, irrigation facilities, weather, et. al., which are assumed to be exogenous.[10] For simplicity, family and hired labor of each type (sex) are assumed to be perfect substitutes[11] but male and female labor are imperfectly substitutible. At least part of both m and f thus represent family labor.

e, a conditioning variable which represents the stock of managerial ability of the household,[12] such that $\delta\Gamma_m/\delta e$, $\delta\Gamma_f/\delta e$, $\delta\Gamma_\kappa/\delta e > 0$, is hypothesized to be a function of both general and specific human capital-- the schooling of the two family members and their work experience on their own farm; i.e.,

(16) $e = \Psi(E_M^L, E_F^L, A_M^L, A_F^L)$

where $\Psi_1, \Psi_2, \Psi_3, \Psi_4 > 0$

It is further assumed that the level of specific experience amassed in off-farm jobs is minimal such that managerial proficiency cannot be hired out.[12]

It is also assumed that there are no direct, i.e., worker effects, of schooling -- schooling and work experience do not directly augment the productivity of workers in such farm tasks as weeding, plowing, reaping, etc.

The budget constraint for landholding households can be written as:

$$(17) \quad \Omega(W_M + W_F) + \Gamma(m, f, \kappa; e) - mW_M - fW_F + I^L = X^L + M^L W_M + F^L W_F$$

or noting that $\lambda_M^L = \Omega - M - m$ and $\lambda_F^L = \Omega - F - f$:

$$(18) \quad \Gamma(m, f, \kappa; e) + \lambda_M^L W_M + \lambda_F^L W_F + I^L - X^L = 0$$

λ_M^L and λ_F^L represent <u>net</u> labor supply and need not be positive; on farms with productive capacity (κ) above some point family labor will not be sufficient for profit (utility) maximization and the family will hire labor so that λ_M^L, $\lambda_F^L < 0$. W_M and W_F are thus the wages paid to hired workers by the landholding households and the wage rates received by family members if they work off the farm (λ_M^L, $\lambda_F^L > 0$). Consistent with the competitive assumption, there are no constraints on the quantities of labor hired or on market labor supplied.

The Lagrangean equation for the landholding household is thus:

$$(19) \quad V^L = g \ (X^L, M^L, F^L, E_M^L, E_F^L) + \mu^L \ [\Gamma(m, f, \kappa; e) + \lambda_M^L W_M +$$
$$\lambda_F^L W_F + I^L - X^L]$$

Assuming interior solutions for all control variables, first-order conditions are:

(20) $\quad g_x - \mu^L = 0$

(21) $\quad g_M - \mu^L W_M = 0$

(22) $\quad g_F - \mu^L W_F = 0$

(23) $\quad \Gamma_m - W_M = 0$

(24) $\quad \Gamma_F - W_F = 0$

(25) $\quad \Gamma(m, f, \kappa; e) + \lambda_M^L W_M + \lambda_F^L W_F + I^L - X^L = 0$

The first three conditions are identical to those pertaining to landless households; the marginal value of each household member's time equals the relevant wage rate irrespective of whether work is performed off the farm. Conditions (23) and (24), however, are the profit-maximizing conditions for variable input use, implying that the level of farm profits is independent of or exogenous to the household's consumption preferences and levels of non-earnings income since the quantities of m and f used will always be those corresponding to profit maximization. The left hand side of (17) thus represents maximum potential income and corresponds to the concept of full income in the standard (landless) model. Given this independence between consumption and production, it is possible to compare the behavior of landless and landholding families in identical consumption equilibria, since we can assume that all households face the same wage rates and prices and we can set $[\Gamma(m, f, \kappa; e) - m W_M - f W_F]_{max} + I^L = I^N$.

The set of differential equations obtained by totally differentiating equations (20) through (25), which can be used to solve for the response of sex-specific net labor supply to changes in wage rates and other exogenous variables in landholding households, is given by (26).

$$
(26) \quad
\begin{bmatrix}
g_{XX} & g_{XM} & g_{XF} & 0 & 0 & -1 \\
g_{MX} & g_{MM} & g_{MF} & 0 & 0 & -W_M \\
g_{FX} & g_{FM} & g_{FF} & 0 & 0 & -W_F \\
0 & 0 & 0 & \Gamma_{mm} & \Gamma_{mf} & 0 \\
0 & 0 & 0 & \Gamma_{fm} & \Gamma_{ff} & 0 \\
-1 & -W_M & -W_F & 0 & 0 & 0
\end{bmatrix}
\begin{bmatrix}
dX^L \\
dM^L \\
dF^L \\
dm \\
df \\
d\mu^L
\end{bmatrix}
=
\begin{bmatrix}
0 \\
\mu^L \, dW_M \\
\mu^L \, dW_F \\
dW_M \quad \Gamma_{m\kappa} \, d\kappa \\
dW_F \quad \Gamma_{f\kappa} \, d\kappa \\
(-\lambda_M^L \, dW_M - \lambda_F^L \, dW_F - \Gamma_\kappa \, d\kappa - dI^L)
\end{bmatrix}
$$

The partial derivatives of male and female market labor supply with respect to the wage rates, obtained by solving the relevant equations in (26), can be written as (27) and (28):

$$
(27) \quad \frac{\delta \lambda_M^L}{\delta W_K} = - \frac{\phi_{i2}^L}{\phi^L} + \lambda_K^L \frac{\phi_{62}}{\phi^L} - \frac{\phi_{j4}}{\phi^L} \qquad
\begin{array}{l}
K = M, \; i = 2, \; j = 4 \\[4pt]
K = F, \; i = 3, \; j = 5
\end{array}
$$

$$
(28) \quad \frac{\delta \lambda_F^L}{\delta W_K} = - \frac{\phi_{i3}^L}{\phi^L} + \lambda_K^L \frac{\phi_{63}}{\phi^L} - \frac{\phi_{j5}}{\phi^L}
$$

where ϕ^L is the bordered Hessian determinant in (26) and ϕ_{rc}^L the cofactor of row r and column c in ϕ^L. However it can be easily shown that

$\phi_{ij}^L / \phi^L = \phi_{ij}^N / \phi^N$ and $\phi_{6i}^L / \phi^L = \phi_{4i}^N / \phi^N$ for i, j = 1, 2, 3. Moreover,

$\phi_{j4}^L / \phi^L = \Gamma_{mx} / \Delta$, and $\phi_{j5}^L / \phi^L = \Gamma_{fx} / \Delta$ where $\Delta = \Gamma_{mm} \Gamma_{ff} - (\Gamma_{mf})^2 \gtrless 0$ and x = m, j = 4, x = f, j = 5, so that:

$$
(29) \quad \frac{\delta \lambda_M^L}{\delta W_K} = \left(\frac{\delta M}{\delta W_K} \right)_{\bar{U}} - \lambda_K^L \left(\frac{\delta M}{\delta I} \right) - \frac{\Gamma_{mx}}{\Delta}
$$

$$(30) \quad \frac{\delta \lambda_F^L}{\delta W_K} = - \left(\frac{\delta F}{\delta W_K}\right)_{\bar{U}} - \lambda_K^L \left(\frac{\delta F}{\delta I}\right) - \frac{\Gamma_{fx}}{\Delta}$$

The first two terms in equations (29) and (30) correspond to the elements of the standard Slutzky equations and are _identical_ to those in (12) and (13) except that the income effect is weighted by net labor supply, λ_K^L, the difference between total family labor supply of member k $(\Omega - M, \Omega - F)$ and labor of type k used in farm production. The third term is the response of labor use to a change in the wage, which must be negative in the own case and positive otherwise, if the male and female labor in farm production are competitive inputs (see Allen [1]). Because λ_K^L will be positive for households supplying labor to the market, the gross wage-net supply relationships are thus ambiguous for landholding households, as in the landless model.[13] However, the sign of the _differential_ between the un-compensated own wage effects on market labor supply in landholding and landless households must be positive. Subtracting respectively (12) and (13) from (29) and (30) yields:

$$(31) \quad \frac{\delta \lambda_M^L}{\delta W_M} - \frac{\delta \lambda_M^N}{\delta W_M} = - \frac{\Gamma_{mm}}{\Delta} + m\left(\frac{\delta M}{\delta I}\right) = - \frac{\delta m}{\delta W_M} + m\left(\frac{\delta M}{\delta I}\right) > 0$$

$$(32) \quad \frac{\delta \lambda_F^L}{\delta W_F} - \frac{\delta \lambda_F^N}{\delta W_F} = - \frac{\Gamma_{ff}}{\Delta} + f\left(\frac{\delta F}{\delta I}\right) = - \frac{\delta f}{\delta W_F} + f\left(\frac{\delta F}{\delta I}\right) > 0$$

Expressions (31) and (32) indicate that if "peasant" households behave in a "neoclassical" manner and if labor markets are competitive the own net market supply response to a wage change in landed households will be algebraically greater than that in landless households. This differential arises because an increase in the own wage lends to a reduction in family

labor time spent on the land owned by the landholding family, Γ_{mm}/Δ, $\Gamma_{ff}/\Delta < 0$, and because the rise in income $\underset{\text{associated}}{\Lambda}$ with the wage increase is attenuated in landholding households (relative to that in landless households supplying the same total amount of labor) by the relevant labor input (m, f) becoming more expensive.[14]

The juxtaposition of landless and landholding market labor supply responses also provides a framework for testing for the existence of the hypothesized linkage between education (experience) and managerial efficiency. Let $\delta M/\delta E_K$ and $\delta F/\delta E_K$ be the unknown relationships between the demand for non-market time and schooling, identical for both landless and landholding households. From (16) and (26), the relationship between market labor supply and schooling in landholding households is thus given by

$$(33) \quad \frac{\delta \lambda_M^L}{\delta E_K} = -\frac{\delta M}{\delta E_K} - \left[\frac{\omega_i (\Gamma_{fe} \Gamma_{mf} - \Gamma_{me} \Gamma_{ff})}{\Delta}\right] = -\frac{\delta M}{\delta E_K} - \frac{\delta m}{\delta E_K} \quad \begin{array}{l} K = M, \ i = 1 \\ \\ K = F, \ i = 2 \end{array}$$

$$(34) \quad \frac{\delta \lambda_M^L}{\delta E_K} = -\frac{\delta F}{\delta E_K} - \left[\frac{\omega_i (\Gamma_{me} \Gamma_{mf} - \Gamma_{fe} \Gamma_{mm})}{\Delta}\right] = -\frac{\delta F}{\delta E_K} - \frac{\delta f}{\delta E_K}$$

The second terms in (33) and (34), the effects of schooling on the demand for farm labor inputs, must be positive if schooling enhances the productivity of inputs. Thus whatever the signs of $\delta M/\delta E_K$, $\delta F/\delta E_K$ the response of market labor supply to educational levels in landholding households will be algebraically less than that in landless households if schooling augments efficiency, the magnitude of the differential being the effect of the schooling attainment of family members on the demand for labor on the farm; i.e.,

$$(35) \quad \frac{\delta \lambda_M^L}{\delta E_K} - \frac{\delta \lambda_M^N}{\delta E_K} = - \frac{\delta m}{\delta E_K} < 0$$

$$(36) \quad \frac{\delta \lambda_F^L}{\delta E_K} - \frac{\delta \lambda_F^N}{\delta E_K} = - \frac{\delta f}{\delta E_K} < 0$$

Similar results would obtain for differential experience effects, if such experience is relevant to managerial efficiency only on a household's own land.

Refutable predictions can also be derived directly from the land-holding model with respect to the relationship between non-labor farm inputs and market labor supply:

$$(37) \quad \frac{\delta \lambda_M^L}{\delta \kappa} = - \Gamma_\kappa \frac{\phi_{62}^L}{\phi^L} - \frac{\Gamma_{f\kappa} \Gamma_{mf} - \Gamma_{m\kappa} \Gamma_{ff}}{\Delta} = - \Gamma_\kappa \left(\frac{\delta M}{\delta I}\right) - \frac{\delta m}{\delta \kappa} < 0$$

$$(38) \quad \frac{\delta \lambda_F^L}{\delta \kappa} = - \Gamma_\kappa \frac{\phi_{63}^L}{\phi^L} - \frac{\Gamma_{m\kappa} \Gamma_{mf} - \Gamma_{f\kappa} \Gamma_{mm}}{\Delta} = \Gamma_\kappa \left(\frac{\delta F}{\delta I}\right) - \frac{\delta f}{\delta \kappa} < 0$$

Since an increase in the level of inputs κ both raises the demand for labor time spent in farm production and, through the income effect, increases the demand for leisure (normality assumed), (37) and (38) must be negative, the magnitude of the farm asset effect being proportional to the marginal product of the factor input, the own leisure-income effect, and the response of labor time to other input changes. Household members on farms more endowed with production assets will thus participate less in the labor market.

Rural Households with Non-earning Wives

In the previous section implications were drawn from the models of landless and landholding households under the assumption that both the husband and wife were employed outside the household sector, although (in

the landholding context) not necessarily in the market. In this section
we briefly consider wage-labor supply effects in similar models in which
wives are not employed, modifying Kneiser's results [11] to apply them to
landholding households.

Kneiser has demonstrated for landless households the existence
of a differential in gross own wage effects on male labor supply between
households in which the wife is employed and households in which she is
not whose sign depends on whether the time of the husband and wife in the
household are (net) complements or substitutes. In particular he shows,
using the notation here, that

$$(39) \quad \left(\frac{\delta M}{\delta W_M}\right)_{\bar{U}} - \left(\frac{\delta M}{\delta W_M}\right)^*_{\bar{U}} + \lambda^N_M \left[\left(\frac{\delta M}{\delta I}\right)^* - \left(\frac{\delta M}{\delta I}\right)\right] \quad \begin{smallmatrix} < \\ > \end{smallmatrix} \ 0 \ <=> \ \left(\frac{\delta M}{\delta W_F}\right)^*_{\bar{U}} \quad \begin{smallmatrix} > \\ < \end{smallmatrix} \ 0$$

where the * refers to families in which the wife allocates all her time
to the household. While in the latter households $(\delta M/\delta W_F)^N$ is not observed,
since W_F does not represent the value of the time of the wife, if $(\delta M/\delta W_F)^N > 0$
for households where the wife is an earner, so that $(\delta M/\delta W_F)^N_{\bar{U}} > 0$, a
comparison of gross own wage effects on male supply in the two types of
landless households can be used as an/internal consistency test of the model.

In the landholding households in which the wife is not employed
either on the family's land or in the labor market, the Lagrangean expression is

$$(40) \quad v^{L*} = g \ (X^L, \ F^L, \ M^L; E^L_M, \ E^L_F) + \mu^{L*} \ [\Gamma(m, \ f, \ \kappa; \ e) + \lambda^L_M \ W_M +$$

$$f \ W_F + I^L - X^L]$$

In this case, the female wage remains a relevant parameter even though it is not the price of the _wife's_ time, since the household will employ hired female labor (=f). Because $dF \equiv 0$, however, first-order condition (22) does not hold. The relevant system of differential equations is thus

$$(41) \quad \begin{bmatrix} g_{XX} & g_{XM} & 0 & 0 & -1 \\ g_{MX} & g_{MM} & 0 & 0 & -W_M \\ 0 & 0 & \Gamma_{mm} & \Gamma_{mf} & 0 \\ 0 & 0 & \Gamma_{fm} & \Gamma_{ff} & 0 \\ -1 & -W_M & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} dX^{L*} \\ dM^{L*} \\ dm \\ dF \\ d\mu^{L*} \end{bmatrix} = \begin{bmatrix} 0 \\ \mu^{L*} dW_M \\ dW_M \quad \Gamma_{m\kappa} d\kappa \\ dW_F \quad \Gamma_{f\kappa} d\kappa \\ (-\lambda_M^L dW_M - f dW_F - \Gamma_\kappa d\kappa - dI^L) \end{bmatrix}$$

It can be easily shown, by solving (41) for wage effects and comparing the results to those in the landless model, that

$$(42) \quad \frac{\delta \lambda_M^{L*}}{\delta W_M} = - \left(\frac{\delta M}{\delta W_M}\right)_{\bar{u}}^* - \lambda_M^L \left(\frac{\delta M}{\delta I}\right)^* - \frac{\Gamma mm}{\Delta}$$

$$(43) \quad \frac{\delta \lambda_M^{L*}}{\delta W_F} = - F \left(\frac{\delta M}{\delta I}\right)^* - \frac{\Gamma mf}{\Delta}$$

Expression (42) indicates that the gross own wage effect on male off-farm labor supply in landholding households where the wife does not work consists of compensated substitution and weighted income effects on male leisure, which are, as in the two-earner households case, identical to those of the corresponding landless household. The third term in (42), the own farm labor substitution effect, however, is identical in all landholding households if female labor can be hired,[15] so that by subtracting (42) from (29)

$$(44) \quad \frac{\delta\lambda_M^L}{\delta W_M} - \frac{\delta\lambda_M^{L*}}{\delta W_M} = (\frac{\delta M}{\delta W_M})_{\underline{u}} - (\frac{\delta M}{\delta W_M})_{\underline{u}}^* + \lambda_M^L [(\frac{\delta M}{\delta I})^* - (\frac{\delta M}{\delta I})]$$

it can be seen that a comparison of male off-farm labor supply gross own wage

effects leads to the same result obtained by Kneiser for landless labor supply,

(39), except that the differential income effect is weighted by net labor

supply. Moreover, as for landless households, the sign of (44) should indicate

whether or not the household time of the farm husband and wife are substitutes

or complements and should be consistent with the sign of $\delta\lambda_M^L/\delta W_F$, since if the

gross cross wage effect on male off-farm labor supply is positive, from (29),

$(\delta M/\delta W_F)_{\underline{u}} > 0$. The sign of expression (43), the gross cross wage effect on

male market supply in households in which the wife is a non-earner, however,

is independent of the relationship between the household time of the family

members, depending only on the relative magnitudes of the income and production-

substitution effects.

3. Empirical Analysis

The Data and Estimation Techniques

In this section the labor supply predictions derived from the

landless and landholding household models formulated under the assumption

of competitive labor markets are tested using data from a national sample

survey of rural households in India collected in three rounds, 1968-69,

1969-70, 1970-71, and coded by the National Council of Applied Economic

Research (NCAER). This survey provides information on a wide variety of

household and farm characteristics, including the number of annual days

worked for pay in agricultural and non-agricultural activities and earnings

from those activities for each household member. The sample used,

stratified into landless and landholding households, is based on information

collected in the third-round of the survey, 1970-71.[16] Households in which

either the head or spouse were absent or were government employees and/or

salaried workers were excluded so that the data are restricted to

cultivators and "casual" workers employed on a monthly or daily basis.[17]

The market (for pay) labor supply equations to be estimated for heads of households and their wives in the two sub-samples are given by (45) and (46):

$$(45) \quad \lambda_K^N = \alpha_K^N + \beta_{1K}^N W_M + \beta_{2K}^N W_F + \beta_{3K}^N I^N + \beta_{4K}^N E_M^N + \beta_{5K}^N E_F^N + \beta_{6K}^N A_M^N$$

$$+ \beta_{7K}^N A_F^N + \beta_{ZK}^N Z_K^N + u_K^N \qquad K = M, F$$

$$(46) \quad \lambda_K^L = \alpha_K^L + \beta_{1K}^L W_M + \beta_{2K}^L W_F + \beta_{3K}^L I^L + \beta_{4K}^L E_M^L + \beta_{5K}^L E_K^L + \beta_{6K}^L A_M^L$$

$$+ \beta_{7K}^L A_F^L + \sum_{i=8}^{11} \beta_{ik}^L \kappa_i + \beta_{2K}^L Z_K^L + u_K^L$$

where the β_{jK}^N, β_{jK}^L are the relevant coefficients for the landless and land-holding households, the Z^N, Z^L are vectors of control variables, to be discussed below, and the u_K^N, u_K^L are stochastic error terms. The theoretical analysis implies the following coefficient or coefficient differential signs:

1. $\beta_{1M}^L - \beta_{1M}^N > 0$ 6. $\beta_{5K}^L - \beta_{5K}^N < 0$

2. $\beta_{2F}^L - \beta_{2F}^N > 0$ 7. $\beta_{6K}^L - \beta_{6K}^N < 0$

3. $\beta_{3K}^N < 0$ 8. $\beta_{7K}^L - \beta_{7K}^N < 0$

4. $\beta_{3K}^L < 0$ 9. $\beta_{1K}^L < 0$ $i = 8....11$ $K = M,F$

5. $\beta_{4K}^L - \beta_{4K}^N < 0$

Sign relations 1 and 2 reflect the differential own gross wage effects in landless and landholding households for the two sexes, from (31) and (32); 3 and 4 are consistent with the assumption that leisure is a normal good; coefficient restrictions 5 through 8 embody the hypothesis that schooling and experience augment the managerial ability of the husband

and wife in agricultural production, from (35) and (36), and the four sign predictions in 9 correspond to the predicted farm production asset effects on net labor supply, from (37) and (38).

Because the NCAER data provide no information on labor input use on the land held by landholding households, net labor supply -- the difference between sex-specific total labor supply ($\Omega - M$, $\Omega - F$) and total farm labor usage (m,f) -- is observed only for households in which the head or wife worked off the farm, i.e., for $\lambda_K^L > 0$. Table 1, which gives household characteristics and days worked by sex and land ownership for the total sample, indicates that while all the heads of landless households and 73.5 percent of their wives worked at least one day for pay, only 40.8 percent of household heads with land and 29.1 percent of their wives supplied any market labor. The dependent variable used to represent net labor supply, days worked for pay, D_K^L, is thus censored, bounded at zero and concentrated at that bound in the landholding sub-sample; i.e.,

$$D_K^L = 0, \qquad \lambda_K^L - u_K^L \leq 0$$

$$D_K^L = \lambda_K^L - u_K^L, \qquad \lambda_K^L - u_k^L \geq 0$$

These properties of the dependent variable imply that if u_K^L is distributed $N(o, \sigma)$ the tobit estimation procedure would be more appropriate than classical least squares in the estimation of equations (46) (see Tobin [28]), where λ_K^L would represent the tobit index and D_K^L the observed days worked off the farm. However, unlike in the usual "corner solution" application of tobit in U.S. female labor supply studies (Rosen [20], Schultz [26]) all males in the landholding sub-sample are earners and the "true" index λ_M^L may take on negative values (for net hirers of labor). The tobit index,

Table 1 Mean Household Characteristics by Sex, Market
Participation and Land Ownership

	MALES			FEMALES		
	NOMARKET	MARKET	TOTAL	NOMARKET	MARKET	TOTAL
			LANDLESS			
n	0	309	309	82	227	309
DAYS	–	247.7	247.7	0	195	143.4
EDH	–	1.04	1.04	1.39	0.92	1.04
EDW	–	0.48	0.48	0.32	0.53	0.48
AGE	–	43.3	43.3	40.4	35.6	36.9
KIDS	–	0.64	0.64	0.60	0.65	0.64
			LANDED			
n	510	352	862	611	251	862
DAYS	0	166	68.0	0	171	49.9
LAND	13.22	4.66	9.72	11.87	4.49	9.72
EDH	2.39	1.53	2.04	2.29	1.43	2.04
EDW	0.48	0.28	0.40	0.46	0.25	0.40
AGE	50.2	44.1	47.7	42.7	36.2	40.8
KIDS	1.01	0.80	0.92	0.95	0.86	0.92

or net supply, coefficients for males are thus appropriately compared to the least squares landless male coefficients, estimated from equation (45) for which censoring is not a problem, $(D_M^N = \lambda_M^N)$ in verifying the restrictions of the neoclassical framework. Only for purposes of predicting the relationships between observed off-farm work and the independent variables are the "expected value" or observed days worked elasticities relevant. In the case of females, however, a proportion in both types of households devote all their time to household activities; thus for the landholding sub-sample the female days worked (for pay), D_F^L, variable is subject not only to censoring but also may be zero-valued because the wife does not participate in any earnings activities.

A second consequence of the lack of information on labor use in landholding households is that daily wage rates paid to laborers by households holding land but supplying no labor to the market, and thus the value of the time of family labor, are not available. The usual procedure employed in U.S. (female) labor supply studies, both to solve the missing wage problem and to eliminate the definitional relationship between the labor supply variable and the computed wage, is to impute a wage rate based on the personal characteristics of the relevant household member.[18] In Indian rural labor markets, however, the chief source of wage rate variability appears to be geographical rather than personal once sex has been taken into account -- annual averages of daily agricultural wages computed within sharply defined categories such as weeding, reaping, plowing, etc., and stratified by sex and adult status vary significantly across Indian districts.[19] Due presumably to the geographical immobility of rural households and the nature of rural

occupations, individual wage rates thus may be determined by the inter-
action of aggregate labor demand and supply in individual labor markets,
which is in turn a function of such factors as the distribution of land-
holdings, availability of water and the existence of rural industry.[20]

Table 2 displays for heads and wives alternative specifications
of wage equations in which the dependent variable is the natural logarithim
of the computed (sex-specific) daily wage based on a combined sample of
landless and landholding households in which either the head or the wife
worked in the market. In specification 1, which corresponds to a human
capital earnings function,[21] schooling attainment and the two age variables
explain less than 3 percent of the variation in male wages and none of the
variance in the female wage rate (the critical F-value (500, 3) = 3.86 (5
percent level)), although the coefficient of the schooling of the male
head is statistically significant. Specification 2 includes characteristics
of the local labor market reported in the sample survey data which may
affect daily wage rates -- dummy variables taking on the value of one if
crops are not adversely affected by weather conditions (WEATHER), if a
factory is present in the village (FACTRY) or if there is any small scale
industry (SSIND) and variables indicating the size of the village (SIZEVLG)
and the distance, in kilometers, between the household's residence and
the village (DSTANCE). These variables, while adding significantly to
the explanatory power of the wage equations for both males and females,
do not, however, completely capture all the important characteristics of
local labor markets which might influence wage levels. As a proxy for
aggregative market conditions, therefore, the natural logarithim of the
sex-specific district-level daily wage pertaining to the district in which
the household resides (LWAGE) is added in specification 3.[22] The inclusion

Table 2   Sex-Specific Ln Wage Equations,
Non-Salary Market Workers

Independent Variable	Male			Female		
	(1)	(2)	(3)	(1)	(2)	(3)
ED	.060 (4.12)	.035 (2.53)	.009 (0.77)	.007 (0.61)	.007 (0.67)	.009 (0.83)
AGE	-.007 (0.57)	-.013 (1.09)	-.018 (1.79)	-.023 (1.55)	.024 (1.72)	.014 (1.08)
AGESQ	.0001 (0.60)	.0001 (1.05)	.0002 (1.58)	-.0003 (1.45)	-.0003 (1.67)	-.0002 (1.06)
WEATHER		.028 (0.50)	.133 (2.59)		.087 (1.43)	.129 (2.22)
FACTRY		.243 (3.28)	.180 (2.78)		.163 (2.15)	.135 (1.86)
SSIND		.0006 (0.01)	.067 (0.99)		.006 (.077)	.079 (1.12)
SIZEVLG($\times 10^{-3}$)		.048 (7.99)	.029 (5.32)		.060 (6.88)	.040 (4.38)
DSTANCE		-1.518 (2.54)	-1.023 (1.96)		.008 (0.01)	-.333 (0.61)
LWAGE			.665 (12.04)			.501 (5.20)
C	1.075	1.149	.642	.127	-.019	-.141
$\bar{R}^2$	.029	.178	.375	-.001	.177	.253
F	5.73	13.60	31.99	0.98	8.00	10.84
n	900	900	900	522	522	522

t-values in parentheses

of this variable not only further improves the explanatory power of the

wage equations but reduces the male schooling coefficient to insignificance;

thus none of the personal characteristics of the individual are significantly

correlated with the wage received. The lack of significance of the

schooling variables in the more fully specified equations explaining the

wage rates of non-salaried and non-government workers of both sexes should

not, however, be interpreted as evidence that schooling does not increase

earnings in India. Aside from the managerial efficiency effect for heads

and wives in farm households, which is discussed below, schooling attain-

ment appears to be positively correlated with the likelihood of being in

a salaried or government job, where computed mean wage rates are higher

than those observed in the sample of workers used.

The results in specification 3 thus are consistent with the

hypothesis that labor is not perfectly mobile geographically in rural

India and that wage rates are not importantly affected by personal characteristics

in the non-salaried, private-sector occupations characterizing the rural

labor market. The relative unimportance of personal attributes in

determining the wages received by market workers thus suggests as well

that rural wages are not significantly affected by the number of days

worked (which is a function of the personal characteristics of the

individual worker), and that, selectivity bias, inherent in a wage

imputation procedure, based on specification 3 of Table 2,[23] may not be

significant since the error components in the wage equations, based on

market conditions, are likely to be minimally correlated with the error

terms in the individual supply (shadow wage) equations, consisting soley

of household variables.

The male and female wage rates used in equations (45) and (46) are thus estimated using the quasi-instrumental variables approach, based on a wage predicting equation including the variables of specification 3 of Table 2 but without schooling and age.[24] Of the other regressors in (45) and (46) requiring comment, the household's combined income from interest, dividends and other personal (non-farm) property income is used to represent non-earnings income (NEARN) and the age of the head and spouse (AGEM,AGEF) are included to capture life-cycle and cohort effects in the landless sample and to serve in addition as proxies for farm-specific work experience in landholding households. The variables representing non-labor farm assets, K_8, K_9, K_{10}, K_{11} consist of a three-year average of gross cropped area, in acres (LAND), and dummy variables representing farm irrigation (IRR = 1 if irrigated, 0 otherwise) weather conditions, and whether or not the farm household resides in an agricultural development district (IADP) and thus is exposed to governmental credit programs (increasing access to credit) and to the introduction of high-yielding grain varieties. Each of these farm assets variables should be positively correlated with farm labor productivity and thus negatively related to market (off-farm) labor supply.[25]

Included in the Z-vector are variables representing proximity to sources of non-agricultural employment - FACTRY, SSIND, DSTNCE - which will be significant determinants of annual days worked for geographically immobile laborers.

The number of children less than age 5 (KIDS) is also added to the market supply equations to test if the presence of young children is importantly related to work decisions in rural areas of a developing country.[26]

However, because this demographic variable is likely to be endogenous (see Rosenzweig and Evenson [23]) two specifications are used, one with the children variable omitted.

Male and Female Market Supply Function Parameter Estimates: Landless and Landholding Households

Tables 3 and 4 report the coefficient estimates obtained for the market labor supply functions of males and females in landless and landholding households using ordinary least squares-instrumental variables (OLS-IV) and tobit (TOBIT-IV); Table 5 summarizes the results in terms of the predicted coefficient signs arising from the theoretical analysis. The overall results, which are not qualitatively altered by the further stratification of the sub-samples according to the wife's participation in earning activities, discussed below, are generally supportive of the neoclassical framework -- of the 22 possible refutable sign restrictions only one, the differential in the male age coefficients in the female supply equations (Table 4), is wrong, although it is not statistically significant. Of the 21 correct coefficient signs, 14 are statistically significant at (at least) the 10 percent level.

The male labor supply results for landless households indicate that the landless male supply curve is (locally) negatively sloped, although the (own) wage coefficient only approaches statistical significance. Interestingly, the own supply elasticity estimate of -0.16 is consistent with estimated male supply elasticities obtained by Kneiser [11] (dependent variable = weeks worked) and Finegan [6] based on U.S. cross-sectional household and aggregate data. The negative signs of the non-earnings income coefficients in all equations are in accord with the expectations

Table 3 OLS-IV and TOBIT-IV Market Supply Equations, Annual Days Worked for Pay by Non-Salaried Males

Independent Variable	Landless OLS-IV		Land-holding OLS-IV		Land-holding TOBIT-IV	
	(1)	(2)	(1)	(2)	(1)	(2)
PWAGEM[†]	-16.29	-17.35	-11.52	-11.27	-7.10	-7.12
	(1.43)	(1.51)	(1.29)	(1.26)	(3.43)	(3.44)
PWAGEF[†]	11.66	13.91	4.68	3.62	62.03	61.02
	(0.69)	(0.82)	(0.29)	(0.22)	(1.72)	(1.69)
EDM	2.77	2.94	-4.18	-4.19	-9.04	-9.18
	(0.78)	(0.84)	(2.03)	(2.03)	(1.97)	(2.00)
EDF	-.971	-.968	-4.18	-4.27	-8.55	-8.77
	(0.43)	(0.43)	(2.00)	(2.04)	(1.82)	(1.86)
NEARN	-.038	-.041	-.005	-.005	-.045	-.045
	(1.19)	(1.27)	(0.64)	(0.65)	(1.48)	(1.47)
LAND			-2.20	-2.14	-12.58	-12.39
			(8.00)	(7.66)	(10.46)	(10.17)
IRR			-22.20	-22.58	-36.14	-36.63
			(3.70)	(3.76)	(2.70)	(2.74)
WEATHER			-1.83	-1.93	-15.14	-15.52
			(0.26)	(0.27)	(0.95)	(0.97)
IADP			-36.59	-36.70	-79.57	-79.66
			(5.43)	(5.45)	(5.82)	(5.83)
FACTRY	7.74	7.21	24.72	24.48	93.67	92.60
	(0.55)	(0.51)	(1.88)	(1.86)	(2.97)	(2.94)
SSIND	4.45	3.68	23.91	22.88	53.72	51.73
	(0.33)	(0.27)	(2.26)	(4.63)	(2.28)	(2.19)
DSTNCE(x10^{-3})	-40.43	-39.48	-68.90	-67.46	-485.96	-482.26
	(0.35)	(0.34)	(1.24)	(1.21)	(2.02)	(2.01)
AGEM	-1.10	-.990	-.327	-.363	-1.24	-1.30
	(1.19)	(1.07)	(0.61)	(0.68)	(1.07)	(1.13)
AGEF	-.499	-.485	-1.44	-1.42	-2.34	-2.34
	(0.50)	(0.49)	(2.59)	(2.58)	(1.91)	(1.91)
KIDS		6.54		-3.06		-6.38
		(1.09)		(1.09)		(0.96)
C	332.29	321.70	212.33	216.58	374.87	384.49
					(8.15)	(8.16)
$\bar{R}^2$	.054	.054	.257	.257		
F/χ^2	2.75	2.60	22.21	20.82	4 59	4 59
n	309	309	862	862	862	862

Asymptotic t-values in parentheses.

[†]Instrumental variable.

Table 4 OLS-IV and TOBIT-IV Market Supply Equations, Annual Days Worked for Pay by Non-Salaried Females

Independent Variable	Landless				Land-holding			
	OLS-IV		TOBIT-IV		OLS-IV		TOBIT-IV	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
PWAGEF[†]	50.78	50.77	50.95	49.93	3.54	3.85	58.18	58.53
	(2.23)	(2.20)	(1.46)	(1.42)	(0.22)	(0.24)	(1.82)	(1.69)
PWAGEM[†]	-61.73	-61.73	-79.95	-79.51	-10.39	-10.46	-82.96	-82.64
	(3.99)	(3.97)	(3.62)	(3.59)	(1.18)	(1.18)	(2.78)	(2.77)
EDF	2.27	2.27	2.94	2.94	-2.87	-2.83	-7.90	-7.79
	(0.75)	(0.75)	(0.75)	(0.75)	(1.39)	(1.37)	(1.21)	(1.18)
EDM	3.17	3.17	2.50	2.40	-4.25	-4.25	-13.46	-13.32
	(0.67)	(0.66)	(0.40)	(0.38)	(2.09)	(2.09)	(2.04)	(2.02)
NEARN	-.061	-.061	-.166	-.165	-.006	-.006	-.094	-.094
	(1.41)	(1.41)	(1.79)	(1.78)	(0.75)	(0.74)	(1.48)	(1.48)
LAND					-1.42	-1.43	-12.20	-12.36
					(5.23)	(5.20)	(7.38)	(7.28)
IRR					-18.35	-18.24	-42.21	-42.01
					(3.14)	(3.12)	(2.28)	(2.22)
WEATHER					-13.49	-13.51	-29.28	-29.44
					(1.96)	(1.97)	(1.33)	(1.34)
IADP					-28.78	-28.74	-94.83	-94.61
					(4.36)	(4.35)	(4.97)	(4.96)
FACTRY	27.40	27.40	34.7	34.91	16.40	16.47	74.33	74.81
	(1.43)	(1.43)	(1.37)	(1.38)	(1.28)	(1.28)	(1.63)	(1.64)
SSIND	39.49	39.49	48.12	48.52	21.36	21.66	68.68	69.86
	(2.17)	(2.16)	(2.02)	(2.03)	(2.05)	(2.07)	(2.04)	(2.06)
DSTNCE (x10^{-3})	-149.74	-149.74	-210.58	-210.88	-28.21	-28.62	-354.67	-356.86
	(0.95)	(0.95)	(1.04)	(1.04)	(0.53)	(0.54)	(1.31)	(1.32)
AGEF	-.577	-.577	-.727	-.733	-1.56	-1.56	-4.07	-4.05
	(0.43)	(0.43)	(0.41)	(0.41)	(2.83)	(2.83)	(2.27)	(2.26)
AGEM	-1.08	-1.08	-1.55	-1.59	.203	.213	-.590	-.556
	(0.86)	(0.86)	(0.95)	(0.97)	(0.39)	(0.40)	(0.35)	(0.34)
KIDS		-.015		-3.00		.895		4.02
		(0.01)		(0.28)		(0.33)		(0.42)
C	270.80	270.83	324.53	329.38	156.46	155.22	359.82	353.54
			(7.67)	(7.20)			(5.46)	(5.25)
$\bar{R}^2$	.144	.141			.166	.165		
F/χ^2	6.19	5.61	3 05	3 05	13.26	12.37	4 22	4 22
n	309	309	309	309	862	862	862	862

Asymptotic t-values in parentheses.

[†] Instrumental variable.

Table 5 Summary of Coefficient Tests--Landless and Land-holding Households

Coefficient Prediction[a]	Estimated Coefficient Sign[b]	
	Males	Females
$\beta_{1M}^L - \beta_{1M}^N > 0$	+	...
$\beta_{2F}^L - \beta_{2F}^N > 0$	...	+
$\beta_{3K}^N < 0$	−	− **
$\beta_{3K}^L < 0$	− *	− *
$\beta_{4K}^L - \beta_{4K}^N < 0$	− **	− **
$\beta_{5K}^L - \beta_{5K}^N < 0$	− *	− *
$\beta_{6K}^L - \beta_{6K}^N < 0$	−	+
$\beta_{7K}^L - \beta_{7K}^N < 0$	−	− **
$\beta_{8K}^L < 0$	− ***	− ***
$\beta_{9K}^L < 0$	− ***	− **
$\beta_{10K}^L < 0$	−	− *
$\beta_{11K}^L < 0$	− ***	− ***

*Statistically significant, .10 level.

**Statistically significant, .05 level.

***Statistically significant, .01 level.

[a]Coefficients correspond to equations (45) and (46) in text.

[b]TOBIT "index" coefficients are used for land-holding sub-sample.

that leisure is a normal good and thus with negative own wage effects

on labor supply, but the estimates only approach statistical significance

in the landless sample.

The Tobit estimates for landholding households indicate that

the _net_ labor supply of farm males is also backward bending, with the own

wage coefficient significantly less than zero at the .01 level; the

observed off-farm days worked own wage elasticity is -.18 Consistent with

the theoretical framework   the coefficient of NEARN is negative,

significant at the .10 level, and the male wage coefficient estimate is

algebraically greater in the landholding then in the landless households,

although the difference is not statistically significant. However, the negative

differential in the male education coefficients between the two households

is significant at the .05 level and supports the hypothesis that the

schooling of male farm managers improves managerial efficiency. Thus

higher schooling levels of male heads of landholding households are

associated with lower levels of (male) net labor supply, despite the small

positive association between male schooling and male market work indicated

in the landless equations. The more negative coefficient for female

schooling in the landholding males equations, significant at the .10 level,

additionally supports the hypothesis that the formal education of farm

wives enhances the productivity of all farm inputs, including the husband's

time in farm production. However, the coefficients of the age variables

in the two households suggest that farming experience has only a minimal

productivity effect; the age coefficient differentials have correct signs

but are not statistically significant. Another difference between the

two sub-samples is that the proximity of a factory or the presence of

small scale industry near the household are significantly and positively associated only with the market days worked of farm males, suggesting that males from farm households are significantly less geographically mobile than landless males. Such a result is consistent with the notion that there are strong imperfections in land and capital markets in India as suggested by Bardhan [3] and Sen [27].

Of the farm production asset variables, all the coefficients also display the theoretically correct (negative) signs, with those of LAND, IRR, and IADP statistically significant at the .01 level. The coefficient estimates suggest that a ten percent increase in gross cropped area is associated with a twelve percent decline in the number of days worked off the farm by heads of landholding households and that the net supply of male labor on farms with irrigation facilities or in IADP districts is approximately 36 and 50 man-days less than that on unirrigated farms or on farms in non-IADP areas.

In the females equations of Table 4 the qualitative results are similar to those obtained for males except that the market supply curves of women appear to be positively sloped, consistent with U.S. studies of female labor supply (Rosen [20], Rosen and Welch [21], Schultz [26]). The Tobit and OLS estimates of the female supply coefficients in the landless sub-sample are not significantly different, due to the high proportion of landless women participating in the market, except that the negative coefficients of NEARN increases in absolute value in the Tobit equation. However, as expected, the OLS and Tobit net female supply coefficients in the landholding sub-sample diverge significantly, with all coefficients increasing in absolute value in the Tobit equation. The Tobit estimates indicate that the observed days worked elasticity

for women from landless households is .67, the observed female off-farm work elasticity is .72 and the net supply elasticity of farm women is 2.0. However, the estimated gross male wage effects on female market supply in both landless and landholding households are negative and significant, consistent with the U.S. results cited above. Indeed, female market labor supply appears quite sensitive to movements in the male wage -- a ten percent rise in the wage rate of males is associated with a 14 percent reduction in the number of days worked by landless females and a 20 percent decrease in the number of days worked off the farm by wives of landholders, the latter in part due to the substitution of the wife's time for male labor in farm production, as suggested in equation (28) of the theoretical analysis.

Of the "predicted" coefficients, all but one conform to the implications of the neoclassical framework -- the differential in the male age effect on female supply between the two households. All the theoretically correct (Tobit) coefficient signs or sign differentials, except for the differential own gross wage effect, are statistically significant (.10 level). Thus, as indicated by the theory and as found for rural males, less market work is supplied by women in households with higher levels of non-earnings income, greater landholdings and irrigated land which are located in agricultural development districts and in areas experiencing good weather. Moreover, the schooling attainment of both household heads and their wives are associated significantly more negatively with the number of market days worked by wives in landholding than in landless households.

The presence of children less than five years of age appears to have no significant effect on the market labor supply of women in India, a result which contrasts with findings based on U.S. data (see Heckman [10], Kneiser [11], Leibowitz [13], Rosen [20], and Schultz [26]), suggesting that <u>market</u> work and child-rearing are not competitive activities in rural areas of developing countries. Thus even if a part of fertility is "excess," in the sense that the number of children born to a family exceeds the number that would have been born if parents had more access to birth control information, the results suggest that the intensification of family planning programs in India should not have a significant impact on the quantities of labor supplied to the market by women (or men).

Finally, the results indicate, in contrast to those for males, that the proximity of small scale industry, and to a lesser extent of a factory, is associated with higher amounts of market work of females in landless as well as landholding households, suggesting that females are significantly less geographically mobile than males in rural India, although female labor supply is not less responsive than male labor supply to changes in economic variables.

<u>Male Market Supply Function Parameter Estimates: Landless and Landholding</u>
<u>Households Stratified by the Earning Status of Wives</u>

Because the proportions of households with non-working (non-earning)[27] wives in the landless and landholding sub-samples differ (26 percent in the former, 38 percent in the latter), the differential in the own male wage coefficients obtained in Table 3 may be contaminated by

differences in aggregation biases within the two household groups, as discussed at the end of section 2. The sub-samples were thus further stratified according to the wife's earning status and male market labor supply regressions were run on the comparable stratified sub-samples. Table 6 reports the results for landless and landholding households with earning wives and for landholding households with non-earning wives. While the own wage coefficients differ in the stratified sub-samples from their aggregate sample counterparts, the differences are not statistically significant and none of the qualitative results summarized in Table 5 are altered. However, the stratification does make the positive differential between the own wage coefficients in landed and landless households (with earning wives) statistically significant at the .10 level. In addition the algebraic decrease in the landless male own wage coefficient when landless households with non-working wives are omitted is consistent with male and female household time being complementary, as indicated by the positive gross cross wage effect. The landless household results thus pass Kneiser's consistency test in (39).

In the stratified landholding sub-samples, the positive cross wage effect in the sample with non-earning wives indicates that a rise in the wage rate of female labor increases the net supply of males even if there is no change in the wife's time allocation, implying from (43) that the income effect of such a change dominates the production substitution effect. The negative gross wage effect in the sub-sample of landholding households in which the wife is an earner is consistent with either net substitutibility or complementarity of spouses' time. However, the less negative own wage coefficient in the non-earning than in the earning-wife sub-sample implies, from (43), in contrast to the landless

Table 6 Market Supply Equations, Annual Days Worked for Pay by
Non-Salaried Males, by Wife's Earning Status

Independent Variable	Earning Wives				Non-Earning Wives	
	Landless (OLS)		Landed (TOBIT)		Landed (TOBIT)	
	(1)	(2)	(1)	(2)	(1)	(2)
PWAGEM	-25.79 (1.61)	-25.64 (1.59)	-3.36 (1.506)	-3.40 (1.52)	-7.34 (1.46)	-7.59 (1.50)
PWAGEF	41.32 (1.51)	42.04 (1.54)	-14.22 (0.32)	-15.05 (0.33)	126.7 (1.65)	123.4 (1.60)
EDM	4.56 (1.16)	4.88 (1.23)	-1.19 (0.24)	-1.32 (0.27)	-16.66 (1.48)	-16.55 (1.47)
EDF	.466 (0.20)	.451 (0.20)	-7.14 (1.71)	-7.28 (1.74)	-56.89 (1.02)	-57.41 (1.04)
NEARN	-.078 (0.96)	-.079 (0.97)	-.042 (0.81)	-.043 (0.82)	-.038 (0.82)	-.041 (0.88)
LAND			-11.78 (8.94)	-11.58 (8.51)	-13.43 (4.82)	-13.08 (4.67)
IRR			-30.51 (2.11)	-30.37 (2.10)	-17.92 (0.53)	-24.11 (0.71)
WEATHER			-6.54 (0.39)	-6.69 (0.40)	-51.91 (1.19)	-53.93 (1.23)
IADP			-56.61 (3.96)	-56.41 (3.95)	-135.77 (3.85)	-138.94 (3.92)
FACTRY	14.53 (0.91)	14.24 (0.89)	61.74 (1.33)	61.74 (1.33)	83.12 (1.34)	80.65 (1.33)
SSIND	14.50 (0.98)	13.58 (0.91)	48.96 (2.06)	46.98 (1.96)	22.69 (0.34)	25.41 (0.37)
DSTNCE(x10^{-3})	-83.63 (0.70)	-85.55 (0.72)	-477.8 (2.03)	-471.1 (2.00)	-1192.4 (0.86)	-1400.31 (1.00)
AGEM	-.707 (0.68)	-.669 (0.64)	-1.06 (0.86)	-1.09 (0.88)	.477 (0.18)	.295 (0.11)
AGEF	-.644 (0.54)	-.601 (0.51)	-2.42 (1.76)	-2.49 (1.81)	-2.06 (0.75)	-1.79 (0.65)
KIDS		4.42 (0.63)		-4.28 (0.60)		-18.67 (1.11)
C	284.6	276.7	367.3 (6.58)	373.6 (6.57)	167.2 (1.55)	193.1 (1.75)
$\bar{R}^2$	.034	.031				
F/χ^2	1.79	1.56				
n	228	228	483	483	379	379

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results, net substitutibility.

4. Conclusion

Little empirical evidence exists on labor supply behavior in
rural areas of developing countries and on the state of competitiveness
of rural labor markets. Yet such information is crucial to any model of
economic development formulated to serve as a useful policy-prescribing
apparatus. In this paper refutable predictions were derived from the
joint consideration of market labor supply behavior in neoclassical
models of landless and landholding households to establish a test of
the competitive framework in the context of rural labor markets in less
developed countries. Empirical results based on micro data from rural
India stratified by sex and landholding status were generally supportive
                    framework
of the neoclassical, suggesting that the annual number of days wage of
employment observed for individuals in rural India is <u>mainly</u> supply rather
than demand determined, as implied by competitive models. Male and
female labor supply function estimates appeared similar in many respects
                                                    of the impact
to econometric labor supply findings based on U.S. data, with the exception∧
of fertility variables on labor supply, which was insignificant. The results
also were consistent with the hypothesis that schooling, for both male and
female members of landholding households, enhances agricultural production
efficiency in India and thus tends to reduce the off-farm labor supply of
cultivators (male and female), but indicate that geographical immobility
is a marked characteristic of rural labor markets, particularly for males
in landholding households and women.

The evidence obtained thus points to the necessity of distinguishing empirically between the behavior of members of landless and landowning families in rural areas of developing countries and calls into question the implications of development models which assume exogenously fixed rural wage rates. The further examination of the micro-foundations of macro development models would appear to be a productive area of research.

FOOTNOTES

1. See also Hansen [9]. Similar descriptive evidence for India is found
    in Rosenzweig [22].

2. Problems involved in taking account of the income tax in U.S. labor supply
    studies are discussed in Rosen [20] and Wales [29].

3. For a discussion of work-time flexibility in empirical studies of labor
    supply see Wales [29].

4. Such data are required to obtain accurate estimates of "pure" income
    effects on labor supply in order to test for the income-compensated
    wage effects implied by the neoclassical model.

5. It is not necessary to specify the nature of the schooling effect on
    non-market time; however, it is assumed that schooling attainment provides
    no direct utility to the family.

6. This assumption is generally employed in U.S. labor studies; see Heckman
    [10], Kneiser [11], Kosters [12], and Schultz [26], but is modified in
    Rosen [20]. Indirect empirical evidence of the independence of the wage
    rate and labor supply in rural India is presented in section 3.

7. Kneiser's result is discussed more fully below.

8. Unfortunately, the author knows of no alternative theories of employment
    distribution in developing countries whose empirical implications have
    been clearly or completely specified.

9. Somewhat over 70 percent of rural households in India own land according
    to both the 1961 Indian Census and the 1970-71 national household survey
    described in section 3.

10. It is assumed, as in almost all studies of India, that the land market is imperfect such that land is not readily bought or sold and access to leased land is restricted. Bell and Zusman [4] cite evidence that almost no households not <u>owning</u> any land are tenants in India and other data which suggests that landholding status is exogenous.

11. Bardhan [3] could not reject the null hypothesis that family and hired labor were perfect substitutes in agricultural production in five of the seven Indian farm surveys he analyzed. No attempt was made to distinguish between male and female (and child) labor, however.

12. The non-tradeability of managerial skill is emphasized in Bell and Zusman [4] as an important factor in determining the demand for leased land. If schooling and managerial ability are positively correlated, then the lack of a market for such a "factor" would additionally imply that the schooling level of tenants, controlling for the amount of land owned, would exceed that of non-tenants. This hypothesis could not be rejected at the .01 level with the data described in section 3.

13. For landholding households in which no labor is supplied to the market $\lambda_K^L < 0$, the gross own relationship between the wage rate and the (family) labor supply of any household member is unambiguously positive because the wage increase <u>lowers</u> net farm income and thus decreases the demand for leisure. Thus on farms using both hired and family laborers the ratio of family to hired labor of sex K will be positively correlated with the wage rate for labor of sex K.

14. The differential in gross <u>cross</u> effects, given by (31)' and (32)', cannot be signed, since the smaller income effect in landholding households may be wholly offset by the production substitution effect, the increase in family labor time of males (females) in response to an increase in the wage rate of females (males).

$$(31)' \quad \frac{\delta\lambda_M^L}{\delta W_F} - \frac{\delta\lambda_M^N}{\delta W_F} = -\frac{\Gamma_{mf}}{\Delta} + {}^f\left(\frac{\delta M}{\delta I}\right) = -\frac{\delta m}{\delta W_F} + {}^f\left(\frac{\delta M}{\delta I}\right)$$

$$(32)' \quad \frac{\delta\lambda_F^L}{\delta W_m} - \frac{\delta\lambda_F^N}{\delta W_M} = -\frac{\Gamma_{fm}}{\Delta} + {}^m\left(\frac{\delta F}{\delta I}\right) = -\frac{\delta f}{\delta W_M} + {}^m\left(\frac{\delta F}{\delta I}\right)$$

15. All farm households are assumed to have identical characteristics, including the same production function.

16. The third-round data were more completely coded than those of the prior two. For additional information or the survey see Sarma [25].

17. Of the total number of landless households, 22 percent were headed by males with yearly salaries in the private or government sector. Less than 10 percent of male heads in landholding households were salaried or government workers. The size of the final sub-sample, however, was principally determined by the availability of earnings and labor supply data: because of missing information on at least one of the variables used in the empirical analysis, the number of (non-salaried) landless households was reduced from 1019 to 309 and the number of landholding households from 2652 to 862. While the measured characteristics available in almost all households indicate that the excluded and included sub-samples are similar, the empricial results reported below cannot be interpreted as reflecting a representative population of rural households in India.

18. See Kneiser [11] and Leibowitz [13] for applications of this technique in U.S. labor supply studies.

19. These computations, reported in Rosenzweig [22], are based on data supplied in [5].

20. For evidence see Rosenzweig [22].

21. Because accurate information on the number of years of schooling as opposed to highest schooling level, for individuals was not available, the Mincerian proxy for work experience, age and schooling years minus 5 was not used. See Mincer [16]. The use of age rather than computed experience has little consequence in terms of explanatory power. See Rosenzweig and Morgan [22].

22. The correlation between the district-level male agricultural wage rates and a linear combination of such rural district characteristics as average landholding size, the proportion of households without land, a measure of the variance in the size-distribution of landholdings, the proportion of irrigated farms, and annual rainfall is .68, where the weights are least squares regression coefficients. The correlation for the female wage rate is .65.

23. See Gronau [7] and Heckman [10] for a discussion of selectivity bias in the U.S. context.

24. The labor supply results reported below are not significantly altered when age and schooling variables are used in the wage-predicting equations; however, significance levels decline.

25. A dummy variable representing farm tenancy did not attain statistical significance in any of the equations and is thus omitted from the reported specifications.

26. The conflict between child-rearing and economic employment may not be as severe in countries such as India as in developed nations. For a fuller discussion of the relationship between fertility and female labor-force participation in the two contexts, see McCabe and Rosenzweig [15].

27. All individuals in the sample were classified as earners or non-earners according to whether or not at least one month during the year was spent as a family or market worker.

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